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NATIONAL DAM INSPECTION PROGRAM. MOUNTAIN SPRINGS LAKE DAM (NDI--ETC(U)
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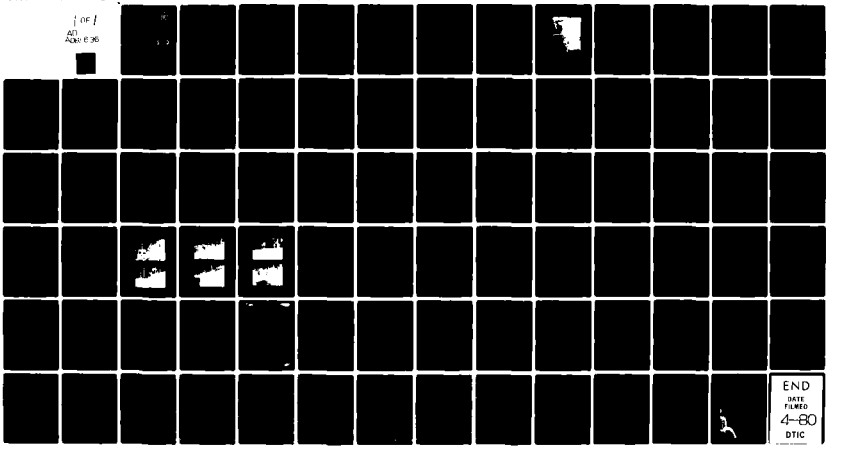

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DELAWARE RIVER BASIN
APPENZELL CREEK, MONROE COUNTY

PENNSYLVANIA

LEVEL II

MOUNTAIN SPRINGS LAKE DAM

NDI ID NO. PA-00770
DER ID NO. 45-42

JACK B. RADER

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Prepared by
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

JANUARY 1980

DELAWARE RIVER BASIN,

APPENZELL CREEK, MONROE COUNTY,

PENNSYLVANIA - Phase I Inspection Report

(6) National Dam Inspection Program

MOUNTAIN SPRINGS LAKE DAM

(NDI-ID No. PA-00770,
DER-ID No. 45-42)

(10) JACK B. RADER

(15) DACW31-80-C-0017

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

Prepared By

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P.O. Box 1963
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DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 20203

(11) JANUARY 1980

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

DELAWARE RIVER BASIN

APPENZELL CREEK, MONROE COUNTY

PENNSYLVANIA

MOUNTAIN SPRINGS LAKE DAM

NDI No. PA-00770
DER ID No. 45-42

JACK B. RADER

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JANUARY 1980

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APPENDICES

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Mountain Springs Lake Dam NDI ID No. PA-00770 DER ID No. 45-42
Size:	Small (17 feet high; 600 acre-feet)
Hazard Classification:	High
Owner:	Jack B. Rader Mountain Springs Drive Reeders, Pa. 18352
State Located:	Pennsylvania
County Located:	Monroe
Stream:	Appenzell Creek
Date of Inspection:	23 October 1979

Based on visual inspection, available records, calculations and past operational performance, and according to criteria established for these studies, Mountain Springs Lake Dam is judged to be unsafe, non-emergency, because the spillway capacity is rated as seriously inadequate. The existing spillway will pass only about 10 percent of the Probable Maximum Flood (PMF) before overtopping of the dam occurs. It is judged that the dam could not withstand the depth and duration of overtopping that would occur for the 1/2 PMF. Failure of the dam would cause an increased hazard for loss of life downstream. As a whole, the dam is judged to be in fair condition.

No stability problems were evident for the dam or appurtenant structures.

The ability of the outlet works to function is unknown. There are no known upstream closure facilities.

Maintenance of the dam is not adequate. Both the dam and the dike are overgrown with trees.

The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Perform additional studies to more accurately ascertain the spillway capacity required for Mountain Springs Lake Dam as well as the nature and extent of measures required to provide adequate spillway capacity. Take appropriate action as required.

(2) Ensure the operational adequacy of the outlet works, and provide properly designed upstream closure facilities.

(3) Remove trees and brush from the dam and dike.

(4) Provide properly designed facilities to safely collect and dispose of standing water along the toe of the dam. The facilities should include measurement devices. Any seepage flow should be monitored, and records should be maintained.

All investigations, studies, designs, and supervision of construction should be performed by a professional engineer experienced in the design and construction of dams. Tree removal should be performed under the guidance of a professional engineer. The seepage monitoring program should also be performed or supervised by a professional engineer.

In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Mountain Springs Lake Dam.

(2) Provide round-the-clock surveillance of Mountain Springs Lake Dam during periods of unusually heavy rains.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

(5) Institute a maintenance program to properly maintain all features of the dam.

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.

FREDERICK FUTCHKO
Project Manager, Dam Section

Date: 11 February 1980

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 29 Feb 1980

MOUNTAIN SPRINGS LAKE DAM

Overview

DELAWARE RIVER BASIN

APPENZELL CREEK, MONROE COUNTY

PENNSYLVANIA

MOUNTAIN SPRINGS LAKE DAM

NDI ID No. PA-00770
DER ID No. 45-42

JACK B. RADER

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SECTION 1

PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Mountain Springs Lake Dam is an earthfill embankment 890 feet long and 17 feet high at its maximum section. The dam is located at the south end of Mountain Springs Lake. An earthen dike is located at the east end of the lake. The dike is 480 feet long and 6 feet high at its maximum section.

The spillway is located near the right abutment of the dam and is a rectangular channel with a control

section. The crest length is 27.3 feet, and the crest is 2 feet lower than the top of the dam. A footbridge crosses the spillway.

The outlet works consists of an 18-inch diameter cast-iron outlet conduit located near the maximum section of the dam. The type of intake is unknown. The outlet conduit projects from the toe of the dam. A gate valve is located in the conduit about 15 feet from its downstream end. The various features of the dam are shown on the Photographs in Appendix C and on the Plates in Appendix E. A description of the geology is presented in Appendix F.

b. Location. Mountain Springs Lake Dam is located on Appenzell Creek in Jackson Township, Monroe County, Pennsylvania, approximately 3.3 miles southeast of Tannersville. Mountain Springs Lake Dam is shown on USGS Quadrangle, Mount Pocono, Pennsylvania, at latitude N 41° 00' 35" and longitude W 75° 21' 35". The location map is shown on Plate E-1.

c. Size Classification. Small (17 feet high, 600 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Mountain Springs Lake Dam. (Paragraph 5.1c(5)).

e. Ownership. Jack B. Rader, Mountain Spring Drive, Reeders, Pennsylvania 18352.

f. Purpose of Dam. Recreation.

g. Design and Construction History. The early history of Mountain Springs Lake Dam is unknown. The earliest record of the dam is 1919, when pertinent data for the dam were compiled by the Pennsylvania Water Supply Commission (PWSC). In 1926, the PWSC directed the Owner, W. J. Costello, to provide additional spillway capacity. Modifications were proposed but never constructed. In 1946, the dam was acquired by the present Owner, Jack B. Rader. The existing structures, except for the footbridge across the spillway, are the same that existed in 1919.

h. Normal Operational Procedure. The reservoir is normally maintained at the spillway crest level.

1.3 Pertinent Data.

a.	Drainage Area. (square miles.)	2.6
b.	Discharge at Damsite. (cfs.)	
	Maximum known flood at damsite	1955 Flood-discharge unknown
	Outlet works at maximum pool elevation	29
	Spillway capacity at maximum pool elevation	239
c.	Elevation. (feet above msl.)	
	Top of dam	1048.1
	Top of dike	1048.0
	Maximum pool	1048.0
	Normal pool (spillway crest)	1046.0
	Upstream invert outlet works	Not Available
	Downstream invert outlet works	1031.1
	Streambed at toe of dam (approximate)	1031.0
d.	Reservoir Length. (miles.)	
	Normal pool	0.42
	Maximum pool	0.44
e.	Storage. (acre-feet.)	
	Normal pool	436
	Maximum pool	600
f.	Reservoir Surface. (acres.)	
	Normal pool	76
	Maximum pool	88
g.	Dam.	
	Type	Earthfill embankment. Also has an earthen dike at east end of lake.
	Length (feet)	
	Dam	890
	Dike	480

g. Dam. (cont'd.)

Height (feet)	
Dam	17
Dike	6
Topwidth (feet)	Varies from 10 to 14.
Side Slopes	
Upstream	Not Available.
Downstream	1V on 2H (average)
Zoning	Unknown
Cutoff	Unknown
Grout Curtain	Unknown

h. Diversion and Regulating Tunnel. None

i. Spillway.

Type	Grouted stone channel
Length of Crest (feet).	27.3
Crest Elevation	1046.0
Upstream Channel	Reservoir
Downstream Channel	Grouted stone chute and channel excavated into earth.

j. Regulating Outlets.

Type	One 18-inch dia. cast-iron pipe.
Length (feet)	80 (Approximate)
Closure	Gate valve near downstream end.
Access	Toe of dam.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. No design data were available for review. The earliest record of the dam is from 1919, when a summary of pertinent data was compiled. Records indicate that there have been no modifications to the dam. No design or as-built drawings were available for review.

b. Design Features. The dam and appurtenances are described in Paragraph 1.2a. The design features are shown on the Photographs in Appendix C and on the Plates in Appendix E.

c. Design Considerations. There are insufficient data to assess the design.

2.2 Construction.

a. Data Available. No construction data are available.

b. Construction Considerations. There are insufficient data to assess the construction of the dam.

2.3 Operation. There are no formal records of operation. Periodic inspections performed by the Commonwealth since 1919 indicate that all structures have performed satisfactorily.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dams and Waterway Management, Department of Environmental Resources, Commonwealth of Pennsylvania (PennDER). The Owner was available for information during the visual inspection. The Owner also researched his files for additional information upon request of the inspection team.

b. Adequacy. There are no design or construction data, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The overall appearance of the dam is fair, with some deficiencies as noted herein. The locations of deficiencies are shown on Exhibit B-1 in Appendix B. Survey data acquired during this inspection are presented on Plates E-2 and E-3. On the day of the inspection, the pool was 0.2 foot above the spillway crest elevation.

b. Dam and Dike. Most of the upstream slope of the dam was submerged and could not be surveyed or inspected. The riprap appears to be in good condition. It extends to the top of the dam. The upstream slope, top, and downstream slope are overgrown with trees having an average diameter of 4 to 6 inches (Photographs A and B). Except for the trees, the downstream slope of the embankment is in satisfactory condition. Two wet areas were observed at the toe of the dam. Although standing water was present, no flow was visible. A large swampy area, which did not have significant amounts of standing water, was also located in the area downstream from the toe of the dam. The approximate locations and extents of the wet areas and the swampy area are shown on Exhibit B-1.

The 6-foot high dike at the east end of the lake is similar in appearance to the dam. The riprap on the upstream slope is satisfactory, but trees are common on both the upstream and downstream slopes (Photograph C). Brush is also growing on the downstream slope. A large swamp begins at the toe of the dike and extends far downstream. No sources of seepage were visible along the toe of the dike.

c. Appurtenant Structures. The spillway is in good condition (Photograph D). The spillway is a rectangular channel with a break in grade that acts as the control section. The approach channel and a short reach of the outlet channel are lined with grouted stone. A wooden footbridge crosses the spillway at the control section. The bridge is supported by the sidewalls of the spillway and by two small piers in the spillway channel

(Photograph E). The underside of the bridge is at the same elevation as the top of the spillway sidewalls.

The downstream end of the outlet conduit projects from the toe of the dam (Photograph F). The end of the conduit is partially buried in mud, and standing water was present. No flow was observed. The inlet area for the conduit was submerged and could not be inspected. A single gate valve is located in a dry, stone masonry valve pit about 15 feet from the downstream end of the conduit. The valve is rusty and partially covered with debris. The Owner stated that it had not been operated since he acquired the dam in 1946. He declined to operate the valve without having a repairman available at the site.

d. Reservoir Area. The watershed is about 90 percent wooded and has only a minor amount of development. Slopes range from steep at the far end of the watershed to mild near the reservoir.

e. Downstream Channel. A roadway embankment with a horseshoe culvert is located about 100 feet downstream from the dam. The roadway embankment is roughly parallel to the dam, and the roadway surface is about 8 to 10 feet lower than the top of the dam. One low-lying dwelling is located 0.1 mile downstream from the dam. At a distance of 0.3 mile downstream, there are two dwellings and some farm buildings near the stream. Another permanent dwelling is located about 1 mile downstream, where the stream enters Trout Lake. Trout Lake Dam is located 1.5 miles downstream. The downstream conditions are shown on Exhibit D-1 in Appendix D.

The area downstream from the dike at the east end of Mountain Springs Lake is in another watershed. A swamp is located immediately downstream from the dike. One summer cottage is located at a distance of 0.3 mile downstream. The first permanent dwellings are located about 1.0 mile downstream.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at spillway crest level, Elevation 1046.0, with excess inflow discharging over the spillway and into the stream. The outlet works is not used.

4.2 Maintenance of Dam. The dam is visited daily by the Owner, who lives and works near the site. The Owner does not make formal inspections of the dam. The brush and grass on the dam are cut annually, but trees are not removed.

4.3 Maintenance of Operating Facilities. It is not known whether the outlet works is operational. It is not maintained.

4.4 Warning Systems in Effect. The Owner stated that there is no emergency operation and warning plan. He stated that the condition of the dam is checked during floods.

4.5 Evaluation of Operational Adequacy. The maintenance of the dam, dike, and outlet works is inadequate. Inspections are necessary to detect hazardous conditions at the dam. An emergency operation and warning system is necessary to reduce the risk of dam failure should adverse conditions develop and to prevent loss of life should the dam fail.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. There are no design data available for the spillway. In 1919, the spillway capacity was estimated to be 300 cubic feet per second (cfs). The capacity computed and used for this report is 239 cfs. Records indicate that the Pennsylvania Water Supply Commission directed the Owner in 1926 to provide a minimum spillway capacity of 1,200 cfs. Proposed plans to increase the capacity were prepared, but the work was never undertaken.

b. Experience Data. No records of maximum pool levels were available. The 1955 Flood resulting from Hurricane Diane is believed to be the flood of record. The Owner stated that he had no knowledge of the dam being overtopped during any flood.

c. Visual Observations.

(1) General. The visual inspection of Mountain Springs Lake Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Dam and Dike. As shown on Plates E-2 and E-3, both the top of the dam and the top of the dike have irregular profiles. The spillway capacity computed and used for this report was based on the lowest top elevation, Elevation 1048.0, which occurs on the dike.

(3) Appurtenant Structures. The bridge piers in the spillway channel reduce the spillway capacity by a small amount. The underside of the bridge is above the level of the top of the dam, and it does not affect spillway capacity.

The condition of the outlet works is uncertain. There is no known upstream closure, and the gate valve on the downstream end might not be functional. Until additional investigations are made, it must be assumed that there is no means of drawing down the reservoir.

(4) Reservoir Area. No conditions were observed in the reservoir area or watershed that might present significant hazard to the dam.

(5) Downstream Conditions. No conditions were observed downstream that might present significant hazard to Mountain Springs Lake Dam. The culvert under the roadway is large enough to pass the flow from the existing spillway without creating significant tailwater levels at the toe of the dam. If the dam were to fail, the roadway embankment would probably fail by overtopping. Failure of the dam would result in flooding of 4 dwellings located along Appenzell Creek between Mountain Springs Lake Dam and Trout Lake. A hazard would also exist to Trout Lake Dam. A Phase I Inspection Report was prepared for Trout Lake Dam in March 1979. Trout Lake Dam, which was classified as intermediate in size and as high hazard; was found to have a seriously inadequate spillway. The downstream conditions indicate that a high hazard classification is warranted for Mountain Springs Lake Dam.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE) for the size (Small) and hazard potential (High) of Mountain Springs Lake Dam, the Spillway Design Flood (SDF) is between one-half of the Probable Maximum Flood (PMF) and the PMF. Because of the downstream conditions, the PMF is selected as the SDF for Mountain Springs Lake Dam. The watershed was modeled with the HEC-1DB computer program. A description of the model is included in Appendix D. The assessment of the dam is based on existing conditions, and the effects of future development are not considered.

(2) Summary of Results. Pertinent results are tabulated at the end of Appendix D. The analysis reveals that Mountain Springs Lake Dam can pass about 10 percent of the PMF without overtopping of the dam.

(3) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix D. Because an occurrence of the 1/2 PMF would result in overtopping of the dam, a failure analysis was performed. It was assumed that Mountain Springs Lake Dam would begin to fail during the 1/2 PMF when the pool level reached Elevation 1048.7, which is 0.6 foot above the low point on the top of the dam. Other assumptions used to

model the failure are described in Appendix D. The resulting outflow was routed through stream sections downstream to Trout Lake Dam. Failure of Mountain Springs Lake Dam would raise water levels at the dwellings by 5.3 feet to 6.1 feet over the levels that existed just prior to failure of the dam. In addition, it was found that Trout Lake Dam would be overtopped and fail if Mountain Springs Lake Dam failed. There is an increased hazard for loss of life. Therefore, the spillway capacity is rated as seriously inadequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Mountain Springs Lake Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for various features.

(2) Dam and Dike. Trees on the embankments are undesirable. The root systems can cause a loosening of the embankment material and create paths along which seepage and internal erosion might occur.

The two wet areas and the swampy area at the toe of the dam appear to be similar in character and extent to conditions described in previous inspection reports between 1919 and 1966. Proper collection and disposal facilities for the water are needed so that any change in condition or quantity can be detected.

There was no visible evidence that the swamp that exists downstream from the dike is directly attributable to seepage through or under the dike. Any concern is minimal because of the height of the dike (6 feet), and because of the sparse development that currently exists downstream from the dike.

(3) Appurtenant Structures. Nothing was observed that was considered hazardous to the stability of the spillway. The operational adequacy of the outlet works is uncertain. It is necessary to have a functional outlet works capable of drawing down the reservoir level. A closure facility is needed at the upstream end of a conduit to prevent having a pipe under pressure through an embankment. If a leak were to develop in a pipe under pressure, it could cause failure of the dam.

c. Operating Records. The Owner has no formal records of operation. According to PennDER records, no stability problems have occurred over the operational history of the dam.

d. Post-Construction Changes. There have been no significant changes made to the dam since the period of record began in 1919.

e. Seismic Stability. Mountain Springs Lake Dam is located in Seismic Zone 1. Earthquake loadings are not considered to be significant for small dams located in Zone 1 when there are no readily apparent stability problems at the dam. Since there were no readily apparent stability problems at the dams, its ability to resist earthquake loadings is assumed to be adequate.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on the visual inspection, available records, calculations, and past operational performance, Mountain Springs Lake Dam is judged to be in fair condition. The existing spillway will pass only about 10 percent of the PMF before overtopping of the dam occurs. It is judged that the dam could not withstand the depth and duration of overtopping that would occur for the 1/2 PMF. Failure of the dam would cause an increased hazard for loss of life downstream. The spillway capacity is rated as seriously inadequate. According to criteria established for these studies, the dam is judged to be unsafe, non-emergency, because the spillway capacity is seriously inadequate.

(2) No stability problems were evident for the dam or appurtenant structures.

(3) The ability of the outlet works to function is unknown. There are no known upstream closure facilities.

(4) Maintenance of the dam is not adequate. Both the dam and the dike are overgrown with trees.

(5) A summary of the features and observed deficiencies is listed below:

Feature and Location	Observed Deficiency
Dam:	Trees; two wet areas and one swampy area at toe.
Dike:	Trees and brush on slopes; swamp at toe.
Outlet Works:	Not maintained; no known upstream closure.

b. Adequacy of Information. The information available is such that a preliminary assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

7.2 Recommendations and Remedial Measures.

a. The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Perform additional studies to more accurately ascertain the spillway capacity required for Mountain Springs Lake Dam as well as the nature and extent of measures required to provide adequate spillway capacity. Take appropriate action as required.

(2) Ensure the operational adequacy of the outlet works, and provide properly designed upstream closure facilities.

(3) Remove trees and brush from the dam and dike.

(4) Provide properly designed facilities to safely collect and dispose of standing water along the toe of the dam. The facilities should include measurement devices. Any seepage flow should be monitored, and records should be maintained.

All investigations, studies, designs, and supervision of construction should be performed by a professional engineer experienced in the design and construction of dams. Tree removal should be performed under the guidance of a professional engineer. The seepage monitoring program should also be performed or supervised by a professional engineer.

b. In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Mountain Springs Lake Dam.

(2) Provide round-the-clock surveillance of Mountain Springs Lake Dam during periods of unusually heavy rains.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

(5) Institute a maintenance program to properly maintain all features of the dam.

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: Mountain Springs Lake Dam

NDI ID NO.: PA-00770 DER ID NO.: 45-42

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	See Plate E-1.
CONSTRUCTION HISTORY	Unknown - constructed prior to 1919.
TYPICAL SECTIONS OF DAM	None.
OUTLETS: Plan Details Constraints Discharge Ratings	None.

A 1

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None.
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	None.
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	None.
POSTCONSTRUCTION SURVEYS OF DAM	None.

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	Unknown.
MONITORING SYSTEMS	None.
MODIFICATIONS	None during period of record.
HIGH POOL RECORDS	None.
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	None during period of record.

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	None.
SPILLWAY: Plan Sections Details	Sections drawn 1931.
OPERATING EQUIPMENT: Plans Details	None.
PREVIOUS INSPECTIONS Dates Deficiencies	1919: Good condition; slight leakage. 1924: No deficiencies noted. 1928: Crest uneven; top lower than spillway walls; some seepage. 1931: Crest uneven; top lower than spillway walls; some brush on downstream slope; swampy between spillway and outlet conduit. 1934: Swampy along downstream toe. 1935: Crest 6" low at spillway; crest uneven; brush and one tree on downstream slope; leakage at old stream channel; swampy along toe

ENGINEERING DATA

ITEM	REMARKS
PREVIOUS INSPECTIONS (Contd)	1938: Crest low at spillway; seepage at toe 200' left of spillway and 250' left of spillway; swampy along toe. 1944: (Inspected but description missing) 1957: Crest 1' low at each abutment; swampy at blowoff; seepage at toe 50' from blowoff. 1966: Trees and brush on top, upstream slope, and downstream slope; some seepage at toe

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: Mountain Springs Lake Dam County: Monroe State: Pennsylvania

NDI ID No.: PA-00770 DER ID No.: 45-42

Type of Dam: Earthfill Hazard Category: High

Date(s) Inspection: 23 October 1979 Weather: Clear Temperature: 75°

Pool Elevation at Time of Inspection: 1046.2 msl/Tailwater at Time of Inspection: 1031.0 msl

Inspection Personnel:

A.H. Whitman Jr. (GFCC) J. B. Rader (Owner)

D.R. Ebersole (GFCC)

D.B. Wilson (GFCC) Recorder

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	None observed.	Downstream slope somewhat irregular.
CREST ALIGNMENT: Vertical Horizontal	See survey data Plates E-2 and E-3.	
RIPRAP FAILURES	Riprap on upstream slope generally in good condition.	Downstream slope has some dumped rock on surface.

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	No deficiencies except low areas.	See Plates E-2 and E-3 for profiles.
ANY NOTICEABLE SEEPAGE	No flowing water observed. Two wet areas near outlet conduit. Swampy area located to right of outlet conduit.	See Exhibit B-1 for location and extent of wet areas and swampy area.
STAFF GAGE AND RECORDER	None.	
DRAINS	None.	
TREES AND BRUSH	Entire embankment covered with trees.	Average size: 4"-6" Dia. Maximum size: 24" Dia.

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
~~CRACKING AND SPALLING OF CONCRETE SURFACES IN~~ OUTLET CONDUIT	18-inch Dia. Cast-iron Pipe. Only downstream end was visible.	Downstream end partially buried in mud.
INTAKE STRUCTURE	No known intake structure.	
OUTLET STRUCTURE	Pipe outlets at toe of dam - no outlet structure.	
OUTLET CHANNEL	Small overgrown natural stream channel.	
EMERGENCY GATE	Gate value in dry stone masonry valve pit located 15 ft. from downstream end of pipe.	No upstream closure. Owner stated valve was never opened by him. Owner declined to operate on day of inspection.

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	No weir - open channel with break in grade.	
APPROACH CHANNEL	Short grouted stone approach channel from reservoir area.	
DISCHARGE CHANNEL	Grouted stone reach 15 ft. long and excavated earthen channel.	
BRIDGE AND PIERS	Wood footbridge over spillway; 2 piers in spillway (each 1.33' wide)	Low chord of bridge is at top of spillway sidewall level.

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	Road embankment and culvert located downstream. Culvert is horseshoe shape and 18' wide x 9.6' high.	Roadway embankment roughly parallels dam at approx. 50'-100' downstream; roadway is approx. 8'-10' lower than top of dam and 22.5' wide.
SLOPES	No evidence of instability.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	1 Low-lying dwelling approx. 0.1 mile downstream; 2 dwellings and farm bldgs. approx. 0.3 mile downstream; 1 dwelling @ Trout Lake.	Trout Lake Dam located 1.5 miles downstream; listed as high hazard in Phase I Inspection Report.

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	

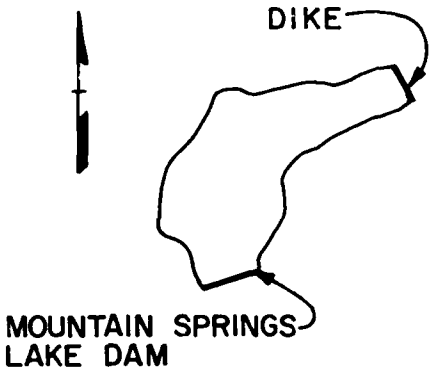
RESERVOIR AND WATERSHED

Sheet 1 of 1

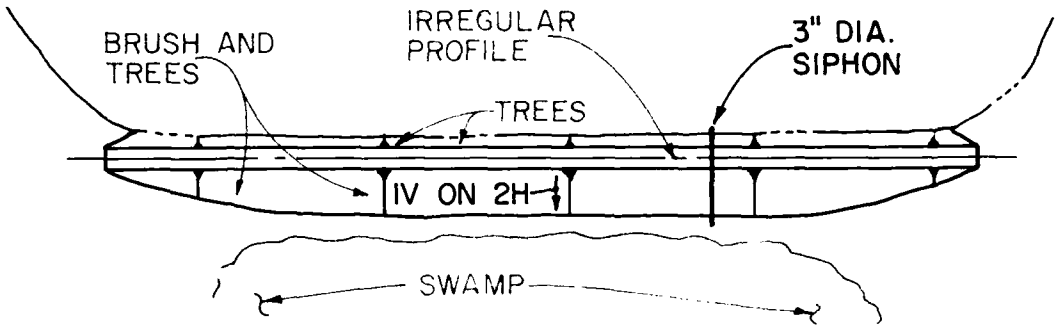
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Very mild slopes surrounding reservoir.	
SEDIMENTATION	None reported by Owner.	
WATERSHED DESCRIPTION	Watershed approx. 90% wooded; minor development.	

DIKE AT EAST END OF MOUNTAIN SPRINGS LAKE

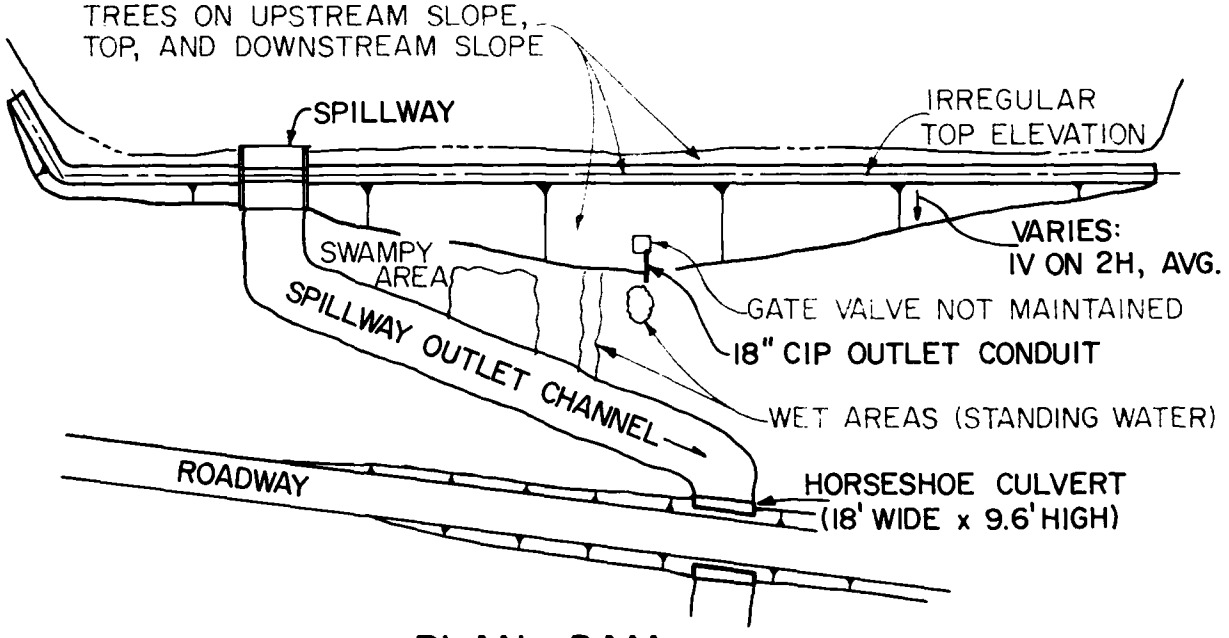
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	
MOVEMENT OR CRACKING AT TOE	None observed.	
SLOUGHING OR EROSION	None observed.	
CREST ALIGNMENT	See Survey Data Plate. E-3	
RIPRAP	Good condition on upstream slope	Dumped rock on downstream face.
ABUTMENT JUNCTIONS	No deficiencies.	
INSTRUMENTATION	None.	
DRAINS	None.	
SEEPAGE	Large swamp begins at toe. No visible seepage points.	Swamp is shown on USGS Map.
TREES AND BRUSH	Trees on both slopes; brush on downstream slope.	
DOWNSTREAM AREA	Swamp begins at toe of dike; 1 cottage 0.25 mile downstream; 2 dwellings 1 mile downstream.	Embankment is 6 feet high; downstream area not same as downstream area for dam.



LOCATION MAP
NOT TO SCALE



PLAN-DIKE
NOT TO SCALE



PLAN - DAM
NOT TO SCALE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MOUNTAIN SPRINGS LAKE DAM

JACK B. RADER

RESULTS OF
VISUAL INSPECTION

JANUARY 1980

EXHIBIT B-1

APPENDIX C

PHOTOGRAPHS

MOUNTAIN SPRINGS LAKE DAM

A. Top of Dam

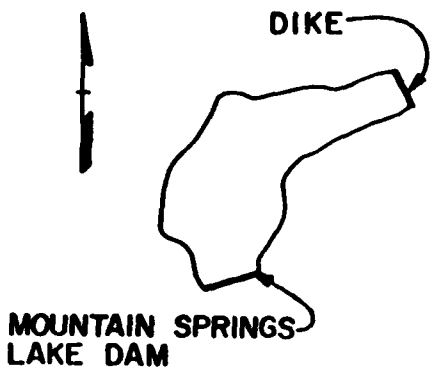
B. Downstream Slope of Dam

C. Dike at East End of Lake

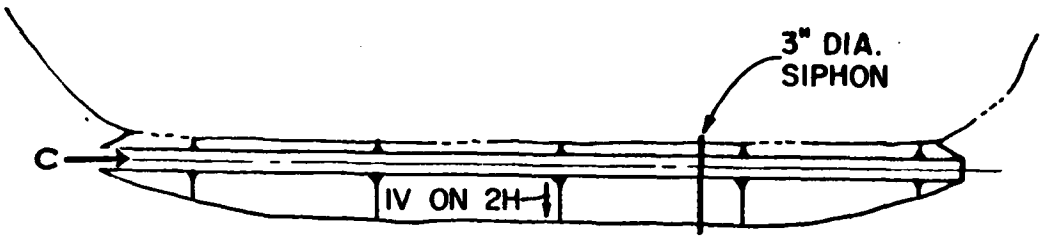
D. Spillway

E. Spillway

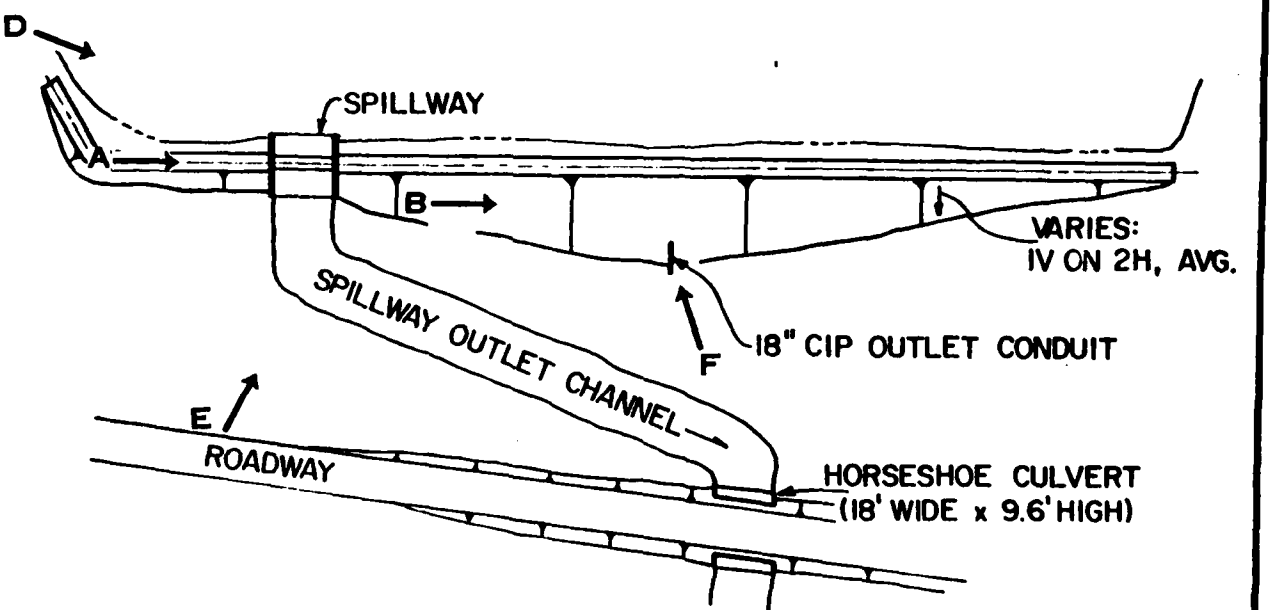
F. Outlet Conduit at Downstream Toe of Dam



:LOCATION MAP
NOT TO SCALE



PLAN-DIKE
NOT TO SCALE



PLAN - DAM
NOT TO SCALE

A - LOCATION AND ORIENTATION OF CAMERA PHOTOGRAPH IDENTIFICATION LETTER

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MOUNTAIN SPRINGS LAKE DAM

JACK B. RADER

GUIDE TO LOCATION OF PHOTOGRAPHS

JANUARY 1980

EXHIBIT C-1

APPENDIX D

HYDROLOGY AND HYDRAULICS

APPENDIX D

HYDROLOGY AND HYDRAULICS

Spillway Capacity Rating:

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

Description of Model:

If the Owner has not developed a PMF for the dam, the watershed is modeled with the HEC-1DB computer program, which was developed by the U.S. Army Corps of Engineers. The HEC-1DB computer program calculates a PMF runoff hydrograph (and percentages thereof) and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. By modifying the rainfall criteria, it is also possible to model the 100-year flood with the program.

APPENDIX D

Delaware River Basin
Name of Stream: Appenzell Creek
Name of Dam: Mountain Springs Lake Dam
NDI ID No.: PA-00770
DER ID No.: 45-42
Latitude: N 41° 00' 35" Longitude: W 75° 21' 25"
Top of Dam Elevation: 1048.1
Streambed Elevation: 1031.0 Height of Dam: 17 ft
Reservoir Storage at Top of Dam Elevation: 600 acre-ft
Size Category: Small
Hazard Category: High (see Section 5)
Spillway Design Flood: Varies from 1/2 PMF to PMF; Select PMF based on downstream conditions

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
No Upstream Dams				

DOWNSTREAM DAMS

Trout Lake Dam	1.5	24	1,107	Phase I Report 3/79
Grubers Lake Dam	2.0	12	83	Included in Trout Lake Dam Phase I Report

Name of Stream: Appenzell Creek Delaware River Basin
Name of Dam: Mountain Springs Lake Dam

DETERMINATION OF PMF RAINFALL & UNIT HYDROGRAPH

UNIT HYDROGRAPH DATA:

Sub-area	Drainage Area (square miles)	Cp (1)	Ct (2)	L miles (3)	L_{ca} miles (4)	L' miles (5)	Tp hours (6)	Map Area (7)	Plate (8)
A-1	2.6	0.45	1.23	2.8	1.5	—	1.89	1	A
Total	2.6								

(See Sketch on Sheet D-4)

(1) & (2): Snyder Unit Hydrograph coefficients supplied by Baltimore District, Corps of Engineers on maps and plates referenced in (7) & (8)

The following are measured from the outlet of the subarea:

(3): Length of main watercourse extended to divide

(4): Length of main watercourse to the centroid

The following is measured from the upstream end of the reservoir at normal pool:

(5): Length of main watercourse extended to divide

(6): $Tp=C_t \times (L \times L_{ca})^{0.3}$, except where the centroid of the subarea is located in the reservoir. Then $Tp=C_t \times (L')^{0.6}$

Initial flow is assumed at 1.5 cfs/sq. mile

Computer Data: QRCSN = -0.05 (5% of peak flow)
RTIOR = 2.0

RAINFALL DATA:

PMF Rainfall Index= 22.3 in., 24 hr., 200 sq. mile.

	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone:	N/A	1
Geographic Adjustment Factor:	N/A	1.0
Revised Index Rainfall:	N/A	22.3

RAINFALL DISTRIBUTION (percent)

Time	Percent
6 hours	111
12 hours	123
24 hours	133
48 hours	142
72 hours	—
96 hours	—

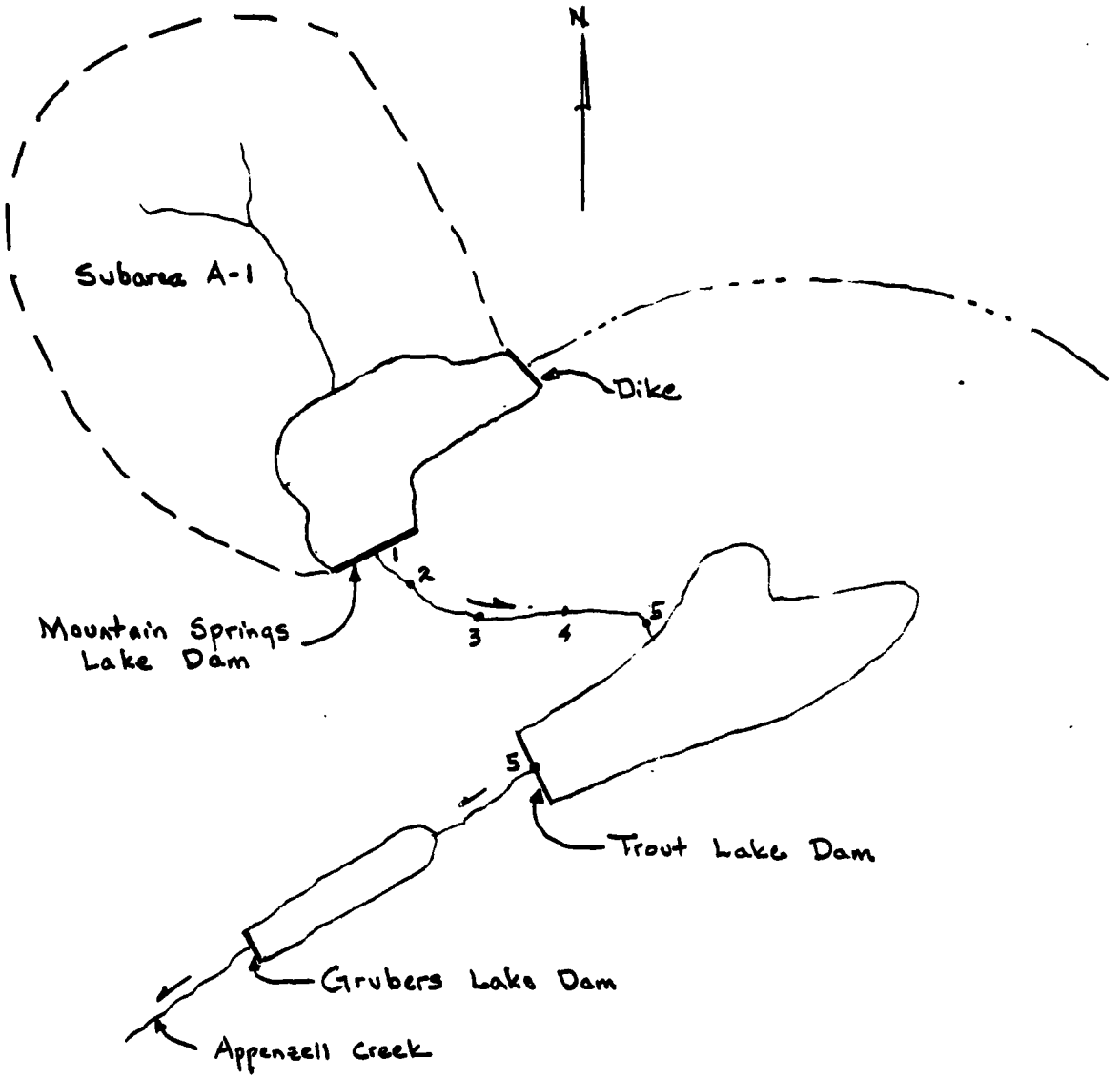
GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____

_____ SHEET NO. ____ OF ____ SHEETS

FOR _____

COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



Mountain Springs Lake Dam
Sketch of System

NOT TO SCALE

8813

Data for Dam at Outlet of Subarea A-1 (see Sketch on Sheet D-4)

Name of Dam: Mountain Springs Lake Dam

SPILLWAY DATA:	Existing Conditions	Design Conditions
Top of Dam Elevation (at dike)	1048.0	N/A
Spillway Crest Elevation	1046.0	
Spillway Head Available (ft)	2.0	
Type Spillway	Rectangular channel w/ control section	
"C" Value - Spillway	3.1	
Crest Length - Spillway (ft)	27.3	
Spillway Peak Discharge (cfs)	239	
Auxiliary Spillway Crest Elev.	N/A	
Auxiliary Spill. Head Avail. (ft)	N/A	
Type Auxiliary Spillway	N/A	
"C" Value - Auxiliary Spill. (ft)	N/A	
Crest Length - Auxil. Spill. (ft)	N/A	
Auxiliary Spillway Peak Discharge (cfs)	N/A	
Combined Spillway Discharge (cfs)	239	N/A

Spillway Rating Curve: $Q = (3.1)(27.3)(H)^{3/2}$

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)
1046.0	0	N/A	0
1047.0	85	N/A	85
1048.0	239	N/A	239
1048.5	335	N/A	335
1049.0	440	N/A	440
1050.0	677	N/A	677
1052.0	1,244	N/A	1,244
1055.0	2,285	N/A	2,285
1060.0	4,433	N/A	4,433

Note: Assume spillway bridge washes away and has no effect.

OUTLET WORKS RATING:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	1031.1		
Invert of Inlet	1032.0 (Assumed)		
Type	C.I.P.		
Diameter (ft) = D	1.5		
Length (ft) = L	80 (Approximate)		
Area (sq. ft) = A	1.77		
N	0.016		
K Entrance	0.5		
K Exit	1.0		
K Friction=$29.1N^2L/R^{4/3}$	2.2		
Sum of K	3.7		
$(1/K)^{0.5} = C$	0.5		
Maximum Head (ft) = HM	17		
$Q = CA\sqrt{2g(HM)}$ (cfs)	29		
Q Combined (cfs)	29		

Note: Ability of outlet works to function is uncertain.

Data for Dam at Outlet of Subarea A-1 (See sketch on Sheet D-4)

Name of Dam: Mountain Springs Lake Dam

STORAGE DATA:

Elevation		Area (acres)		Storage million gals	acre-ft		Remarks
1028.8	=ELEVO*	0		0	0		
1046.0	=ELEV1	76	=A1	142	436	=S1	DER Record Data
1048.0		88		196	600		
1060.0		183		715	2,195		

* ELEVO = ELEV1 - $(3S_1/A_1)$
** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is 5 percent of subarea watershed.

BREACH DATA: See Next Sheet for Explanation of Assumed Failure.

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: Sandy Clay - Sandy Silt

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) 2 fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = (2/3) x H) & $A = L \cdot$depth

HMAX = $(4/9\ V^2/C^2)$ = 0.2 ft., C = 3.1 Top of Dam El.= 1048.5

HMAX + Top of Dam El. = 1048.7 = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = 80 ft (width of bottom of breach)
Z = 1V on 1H (side slopes of breach)
ELBM = 1031.0 (bottom of breach elevation, minimum of zero storage elevation)
WSEL = 1046.0 (normal pool elevation)
T FAIL= 6 mins = 0.1 hrs (time for breach to develop)

Description of Assumed Failure:

A. General. The minimum top of dam elevation is located on the dike at the east end of the Lake and is Elevation 1048.0. If failure were to occur at the dike, the outflow would travel eastward through a sparsely developed area. However, failure at the dike cannot be assured. To evaluate the most serious possibility, failure was assumed to occur at the dam. Outflow over the dike was not included because it would enter a different watershed.

B. Failure at Mountain Springs Lake Dam. The pool elevation at which failure occurred was not based on the minimum elevation of the top of the dam. The minimum elevation, Elevation 1048.1, occurs at the right abutment, and overtopping failure at that point would result in failure of a reach of low embankment. The top of dam elevation used in computing the failure elevation (FAILEL) was the elevation at which a long reach of the maximum section would be overtopped (Elevation 1048.5).

C. Downstream Considerations. The resulting failure hydrograph from Mountain Springs Lake Dam was routed through stream sections downstream to Trout Lake Dam and then through Trout Lake Dam. Data for Trout Lake Dam was obtained from the Phase I Inspection Report that was performed for that dam in March 1979. The data is presented on Sheets D-8 and D-9.

Data for Dam Downstream from Mountain Springs Dam (see Sketch on Sheet D-4)

Name of Dam: Trout Lake Dam

SPILLWAY DATA:	Existing Conditions	Design Conditions
Top of Dam Elevation	947.0	
Spillway Crest Elevation	943.0	
Spillway Head Available (ft)	4.0	
Type Spillway	Concrete Weir	
"C" Value - Spillway	3.3	
Crest Length - Spillway (ft)	35	
Spillway Peak Discharge (cfs)	924	
Auxiliary Spillway Crest Elev.	N/A	
Auxiliary Spill. Head Avail. (ft)	N/A	
Type Auxiliary Spillway	N/A	
"C" Value - Auxiliary Spill. (ft)	N/A	
Crest Length - Auxil. Spill. (ft)	N/A	
Auxiliary Spillway Peak Discharge (cfs)	N/A	
Combined Spillway Discharge (cfs)	924	

Spillway Rating Curve: $Q = (3.3)(35)(H)^{3/2}$

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)

OUTLET WORKS RATING:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet			
Invert of Inlet			
Type			
Diameter (ft) = D			
Length (ft) = L			
Area (sq. ft) = A			
N			
K Entrance			
K Exit			
K Friction $=29.1N^2L/R^{4/3}$			
Sum of K			
$(1/K)^{0.5} = C$			
Maximum Head (ft) = HM			
$Q = CA\sqrt{2g(HM)}$ (cfs)			
Q Combined (cfs)			

Not Applicable for Analysis

Data for Dam Downstream from Mountain Spr. Dam (See sketch on Sheet D-4)

Name of Dam: Trout Lake Dam

STORAGE DATA: Obtained from Phase I Inspection Report

Elevation		Area (acres)		Storage million gals	Storage acre-ft		Remarks
924.0	=ELEVO*	1.4		0	0		
943.0	=ELEV1	96	=A1		690	=S1	
947.0					1107		Top of Dam
960.0		176			2968		

* ELEVO = ELEV1 - $(3S_1/A_1)$
** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is _____ percent of subarea watershed.

BREACH DATA: Obtained from Phase I Inspection Report

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: _____

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) _____ fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = (2/3) x H) & A = L·depth

HMAX = $(4/9\ V^2/C^2)$ = _____ ft., C = ____ Top of Dam El.= 947.0

HMAX + Top of Dam El. = 947.8 = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = 80 ft (width of bottom of breach)
Z = 1 (side slopes of breach)
ELBM = 927.0 (bottom of breach elevation, minimum of zero storage elevation)
WSEL = 943.0 (normal pool elevation)
T FAIL= 60 mins = 1 hrs (time for breach to develop)

Selected Computer Output

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
```

```
    1  A1                                NATIONAL DAM INSPECTION PROGRAM
    2  A2                                      MOUNTAIN SPRINGS LAKE
    3  A3                                       APPENZELL CREEK
    4  B    300       0      15       0       0       0       0       0      -4       0
    5  B1     5
    6  J      1       9       1
    7  J1   1.0      .5      .4      .3      .25      .20      .15      .10      .05
    8  K      0       1                                                 1
    9  K1       RUNOFF INTO MOUNTAIN SPRINGS LAKE
   10  M      1       1     2.6                 2.6                                1
   11  P             22.3     111     123     133     142
   12  T                                                         1.0      .05              .05
   13  W   1.89     .45
   14  X   -1.5   -0.05     2.0
   15  K      1       1                                                 1
   16  K1       ROUTE THROUGH MOUNTAIN SPRINGS LAKE DAM
   17  Y                                        1
   18  Y1     1                                                        -1046
   19  $A     0      76     183
   20  $E1028.8    1046    1060
   21  $S  1046    27.3     3.1     1.5
   22  $D1048.1
   23  $L     1      10      40     110     283     905    1000    1050    1100
   24  $V1048.1  1048.2  1048.3  1048.5  1048.6  1048.9  1049.2  1051.7    1060
   25  K     99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1 1.00	RATIO 2 .50	RATIO 3 .40	RATIO 4 .30	RATIO 5 .25	RATIO 6 .20	RATIO 7 .15	RATIO 8 .10	RATIO 9 .05
HYDROGRAPH AT	1	2.60	1	5381.	2691.	2152.	1614.	1345.	1076.	807.	538.	269.
	(	6.73)	(	152.38)(	76.19)(	60.95)(	45.71)(	38.09)(	30.48)(	22.86)(	15.24)(	7.62)
ROUTED TO	1	2.60	1	5327.	2652.	2109.	1538.	1229.	892.	495.	266.	105.
	(	6.73)	(	150.86)(	75.09)(	59.71)(	43.54)(	34.82)(	25.25)(	14.01)(	6.97)(	2.97)

SUMMARY OF DAM SAFETY ANALYSIS

MOUNTAIN SPRINGS LAKE DAM

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1046.00	1046.00	1049.10
STORAGE	436.	436.	609.
OUTFLOW	0.	0.	258.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1049.95	1.85	785.	5327.	19.00	41.75	0.00
.50	1049.40	1.30	731.	2652.	14.75	42.00	0.00
.40	1049.27	1.17	718.	2109.	13.50	42.00	0.00
.30	1049.11	1.01	702.	1538.	11.75	42.25	0.00
.25	1049.01	.91	693.	1229.	11.00	42.75	0.00
.20	1048.89	.79	681.	892.	9.75	43.25	0.00
.15	1048.67	.57	660.	495.	7.75	44.25	0.00
.10	1048.03	0.00	602.	244.	0.00	45.25	0.00
.05	1047.15	0.00	528.	105.	0.00	45.75	0.00

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
    1                 A1                                NATIONAL DAM INSPECTION PROGRAM
    2                 A2                                      MOUNTAIN SPRINGS LAKE
    3                 A3                                       APPENZELL CREEK
    4                 B     300        0        6        0        0        0        0        0       -4        0
    5                 B1      5
    6                 J       2        2        1
    7                 J1     .5       .2
    8                 K       0        1                                                  1
    9                 K1        RUNOFF INTO MOUNTAIN SPRINGS LAKE
   10                 M       1        1      2.6               2.6                                 1
   11                 P                22.3     111      123      133
   12                 T                                                                 1.0      .05               .05
   13                 W    1.89      .45
   14                 X    -1.5    -0.05      2.0
   15                 K       1        1                                                  1
   16                 K1        ROUTE THROUGH MOUNTAIN SPRINGS LAKE DAM
   17                 Y                                         1        1
   18                 Y1      1                                                        -1046
   19                 $A      0       76      183
   20                 $E1028.8     1046     1060
   21                 $$   1046     27.3      3.1      1.5
   22                 $D1048.1
   23                 $L      1       10       40      110      583      905     1000     1050     1100
   24                 $V1048.1  1048.2   1048.3   1048.5   1048.6   1048.9   1049.2   1051.7   1060
   25                 $B     80        1     1031       .1     1046     1059
   26                 $B     80        1     1031       .1     1046   1048.7
   27                 K       1        2                                                  1
   28                 K1        STREAM X-SECT
   29                 Y                                         1        1
   30                 Y1      1                                                        -1
   31                 Y6    .09      .07      .05     1018     1040      650      .02
   32                 Y7      0     1040      600     1020      620     1020      621     1018      641     1018
   33                 Y7    642     1020      680     1020     1450     1040
   34                 K       1        3                                                  1
   35                 K1        STREAM X-SECT
   36                 Y                                         1        1
   37                 Y1      1                                                        -1
   38                 Y6    .09      .07      .05     1002     1020      850      .02
   39                 Y7      0     1040      220     1020      420     1005      421     1002      441     1002
   40                 Y7    442     1005     1190     1020     1800     1040
   41                 K       1        4                                                  1
   42                 K1        STREAM X-SECT
   43                 Y                                         1        1
   44                 Y1      1                                                        -1
   45                 Y6    .09      .07      .09      973      990     1850    .0125
   46                 Y7      0     1000      200      980      350      976      351      973      371      973
   47                 Y7    372      976      440      980      750     1000
   48                 K       1        5                                                  1
   49                 K1        STREAM X-SECT
   50                 Y                                         1        1
```

D-14

Y1	1						-1			
Y6	.09	.07	.04	953	970	1750	.017			
Y7	0	980	200	960	370	956	371	953	391	953
Y7	392	956	400	960	630	980				
K	1	6					1			
K1	ROUTE THROUGH TROUT LAKE DAM									
Y				1	1					
Y1	1						-943			
SA	1.4	96	176							
SE	924	943	960							
SS	943	35	3.3	1.5						
SD	947									
SL	250	250								
SV	947	960								
SR	80	1	927	1	943	1000				
SB	80	1	927	1	943	947.8				
K	99									

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .20
HYDROGRAPH AT	1	2.60	1	2686.	1074.
	(	6.73)	(	76.05)(	30.42)(
			2	2686.	1074.
			(	76.05)(	30.42)(
ROUTED TO	1	2.60	1	2634.	858.
	(	6.73)	(	74.58)(	24.29)(
			2	20692.	20468.
			(	585.96)(	579.59)(
ROUTED TO	2	2.60	1	2634.	857.
	(	6.73)	(	74.58)(	24.28)(
			2	21203.	20884.
			(	600.40)(	591.37)(
ROUTED TO	3	2.60	1	2633.	857.
	(	6.73)	(	74.56)(	24.26)(
			2	19935.	19623.
			(	564.49)(	555.66)(
ROUTED TO	4	2.60	1	2628.	852.
	(	6.73)	(	74.42)(	24.12)(
			2	17815.	17459.
			(	504.46)(	494.38)(
ROUTED TO	5	2.60	1	2625.	850.
	(	6.73)	(	74.34)(	24.06)(
			2	16374.	15956.
			(	463.66)(	451.82)(
ROUTED TO	6	2.60	1	1777.	359.
	(	6.73)	(	50.32)(	10.18)(
			2	18584.	17194.
			(	526.24)(	486.87)(

SUMMARY OF DAM SAFETY ANALYSIS

MOUNTAIN SPRINGS LAKE DAM

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1046.00	1046.00	1049.10
STORAGE	436.	436.	609.
OUTFLOW	0.	0.	258.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1049.40	1.30	730.	2634.	12.60	17.90	0.00
.20	1048.97	.77	680.	858.	8.90	19.30	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1046.00	1046.00	1049.10
STORAGE	436.	436.	609.
OUTFLOW	0.	0.	258.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1048.76	.66	670.	20692.	.90	16.20	16.10
.20	1048.71	.61	665.	20468.	1.09	18.40	18.30

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	2634.	1023.0	17.90
.20	857.	1021.5	19.30

PLAN 2 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	21203.	1028.3	16.30
.20	20884.	1028.2	18.50

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	2633.	1009.5	17.90
.20	857.	1006.5	19.40

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	19935.	1014.0	16.30
.20	19623.	1013.9	18.50

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	2628.	980.2	18.10
.20	852.	978.0	19.50

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	17815.	986.3	16.60
.20	17459.	986.2	18.60

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	2625.	960.0	18.20
.20	850.	957.8	19.70

PLAN 2 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	16374.	965.8	16.50
.20	15956.	965.7	18.70

SUMMARY OF DAM SAFETY ANALYSIS

TROUT LAKE DAM

PLAN 1 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	943.00	943.00	947.00
STORAGE	690.	690.	1107.
OUTFLOW	0.	0.	924.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	947.81	.81	1199.	1777.	5.60	20.60	0.00
.20	945.13	0.00	904.	359.	0.00	23.90	0.00

PLAN 2 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	943.00	943.00	947.00
STORAGE	690.	690.	1107.
OUTFLOW	0.	0.	924.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	948.71	1.71	1306.	18584.	.82	17.80	16.80
.20	948.51	1.51	1282.	17194.	.76	20.00	19.00

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
_____ SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

Mountain Springs Lake Dam
Summary of Pertinent Results

PMF Rainfall = 25.33 inches

Multi-ratio Analysis

Mountain Springs Lake Dam:	PMF	1/2 PMF
Runoff (inches)	23.06	11.53
Inflow (cfs)	5,381	2,691
Outflow (cfs)	5,327	2,652
Depth of Overtopping (feet)	1.85	1.30
Duration of Overtopping (hours)	19.0	14.75

Breach Analysis (1/2 PMF)

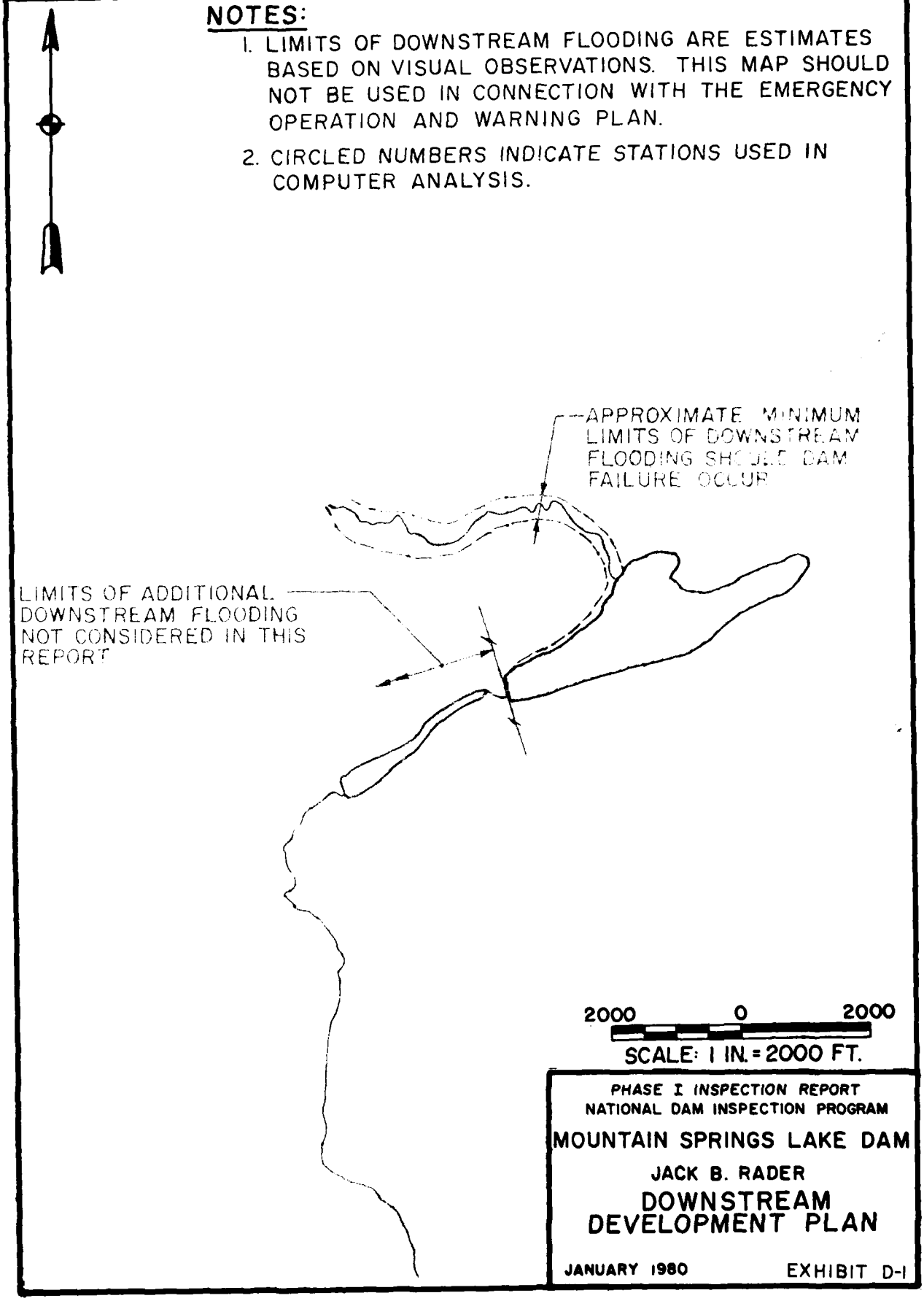
Station Number	Stream Depth (ft) No Failure	Failure	Δ Depth (ft)
2	5.0	10.3	5.3
3	6.5	12.0	5.5
4	7.2	13.3	6.1
5	7.0	12.8	5.8
Trout Lake Dam	Failure by overtopping (1.7 ft)		

Notes:

1. Station Number Identification:
   - Station 2 - 1 Dwelling
   - Station 3 - 2 Dwellings
   - Station 5 - 1 Dwelling

NOTES:

1. LIMITS OF DOWNSTREAM FLOODING ARE ESTIMATES BASED ON VISUAL OBSERVATIONS. THIS MAP SHOULD NOT BE USED IN CONNECTION WITH THE EMERGENCY OPERATION AND WARNING PLAN.
2. CIRCLED NUMBERS INDICATE STATIONS USED IN COMPUTER ANALYSIS.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MOUNTAIN SPRINGS LAKE DAM

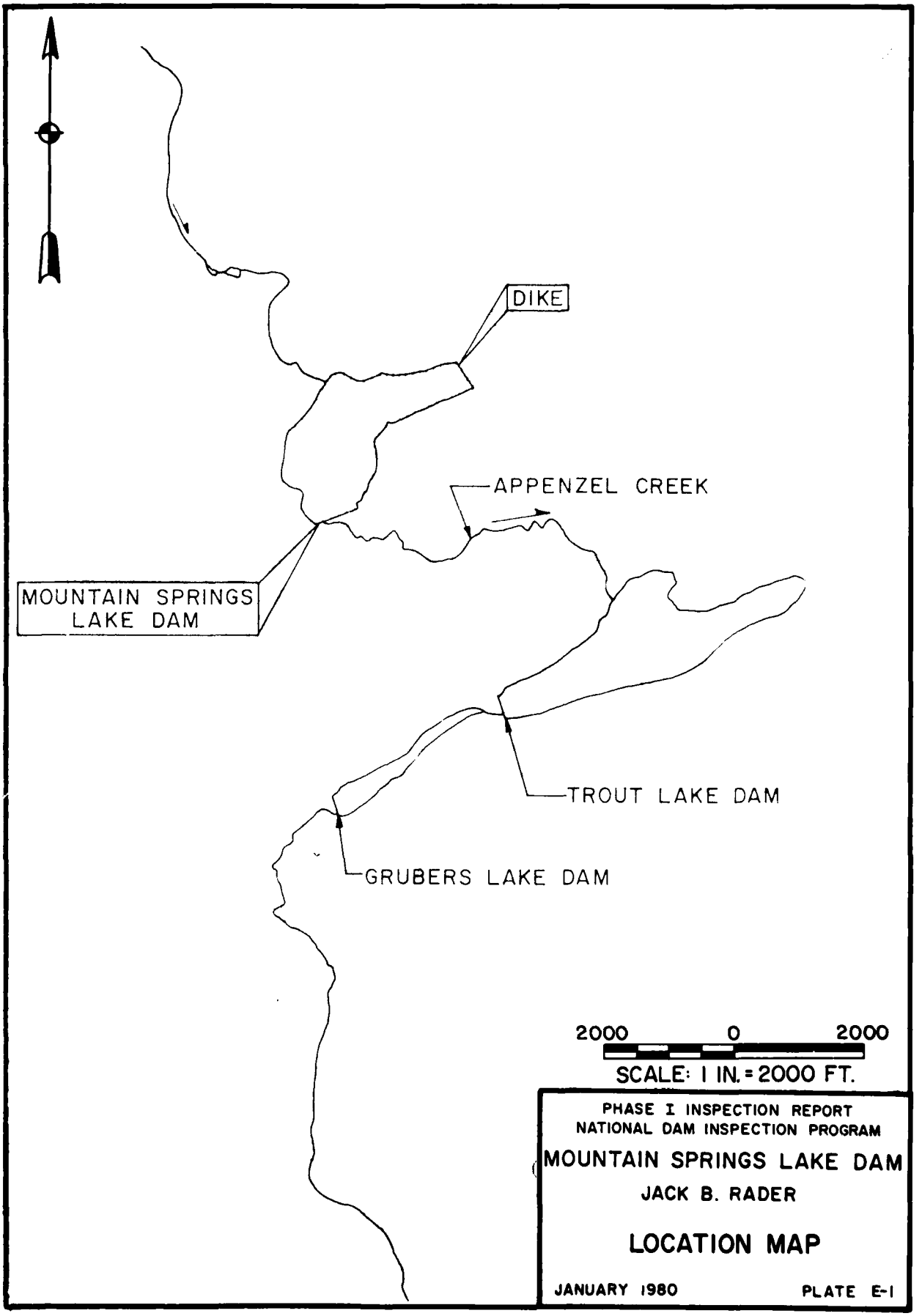
JACK B. RADER

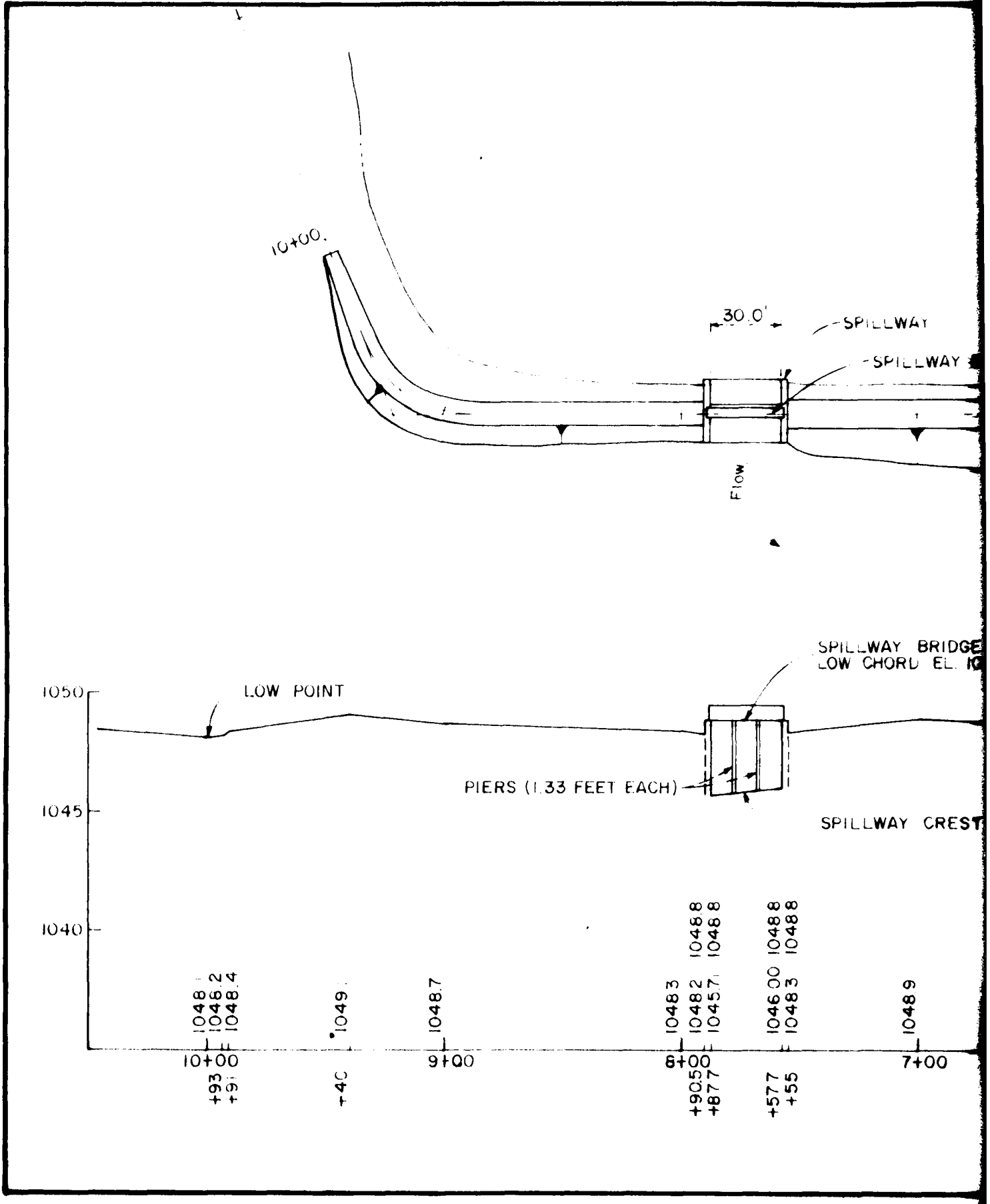
DOWNSTREAM DEVELOPMENT PLAN

JANUARY 1980 EXHIBIT D-1

APPENDIX E

PLATES


DIKE
APPENZEL CREEK
MOUNTAIN SPRINGS LAKE DAM
TROUT LAKE DAM
GRUBERS LAKE DAM
2000 0 2000
SCALE: 1 IN. = 2000 FT.
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
MOUNTAIN SPRINGS LAKE DAM
JACK B. RADER
LOCATION MAP
JANUARY 1980
PLATE E-1


10+00.
30.0'
SPILLWAY
SPILLWAY
Flow
SPILLWAY BRIDGE
LOW CHORD EL. 10
1050
LOW POINT
PIERS (1.33 FEET EACH)
1045
SPILLWAY CREST
1040
1048.8
1048.8
1048.8
1048.8
1048.4
1048.2
1049
1048.7
1048.3
1048.2
1045.7
1046.00
1048.3
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10+00
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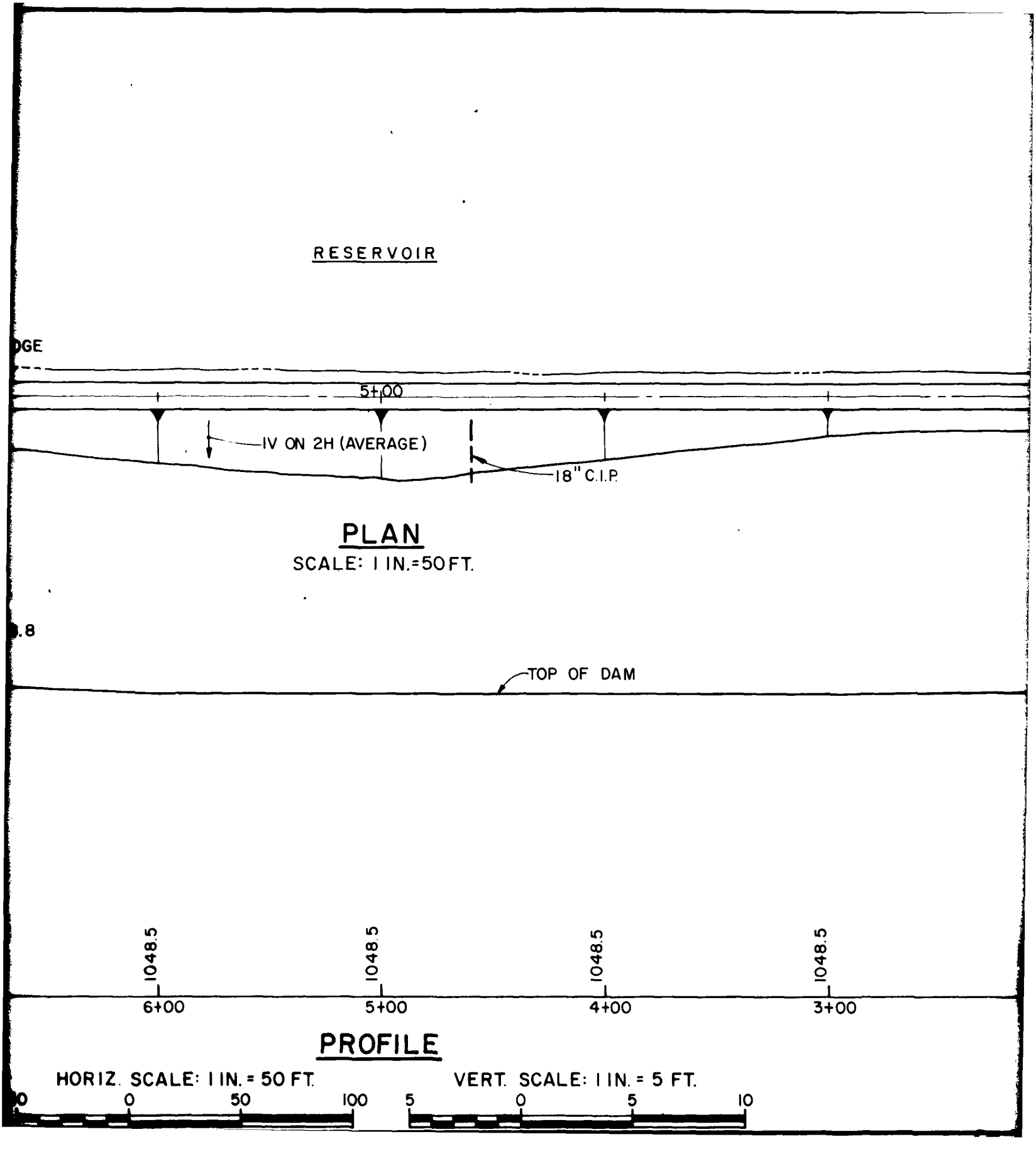
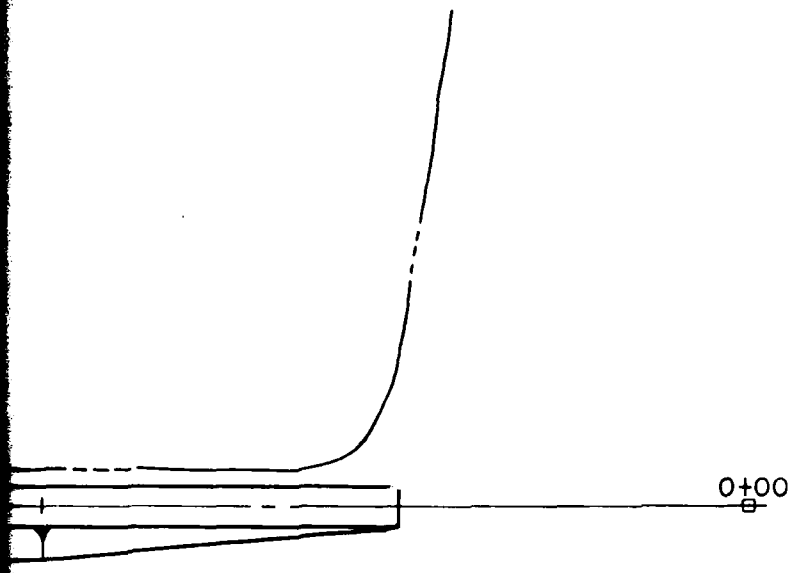
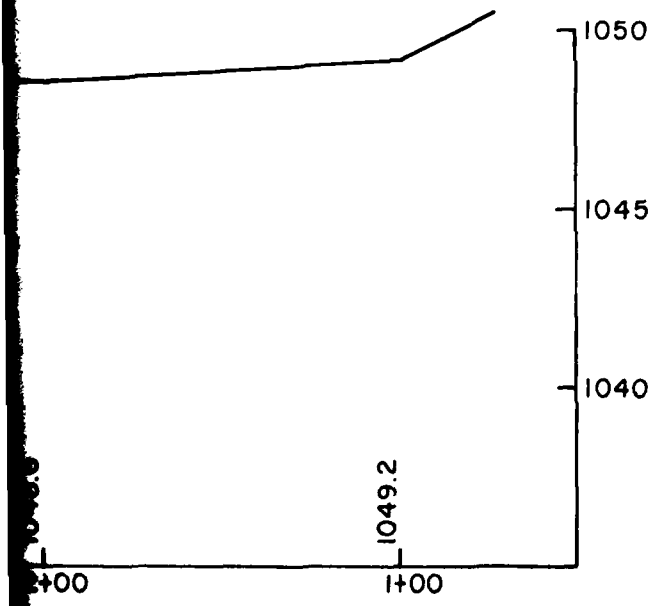
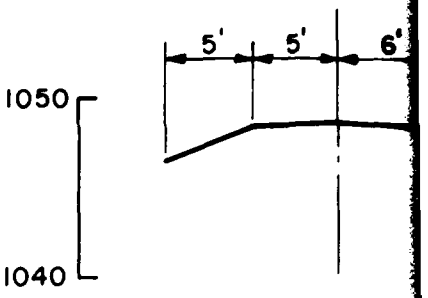
8+00
7+00
+93
+90
+40
+90
+87
+57
+55

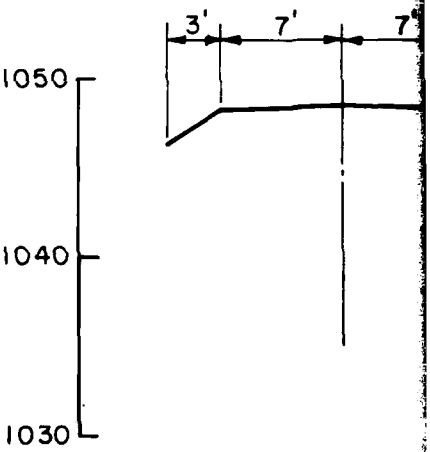

RESERVOIR
GE
5+00
IV ON 2H (AVERAGE)
18" C.I.P.
PLAN
SCALE: 1 IN.=50 FT.
.8
TOP OF DAM
1048.5
1048.5
1048.5
1048.5
6+00
5+00
4+00
3+00
PROFILE
HORIZ. SCALE: 1 IN. = 50 FT.
VERT. SCALE: 1 IN. = 5 FT.
0
0
50
100
5
0
5
10





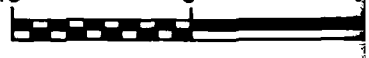


STA. 3+0

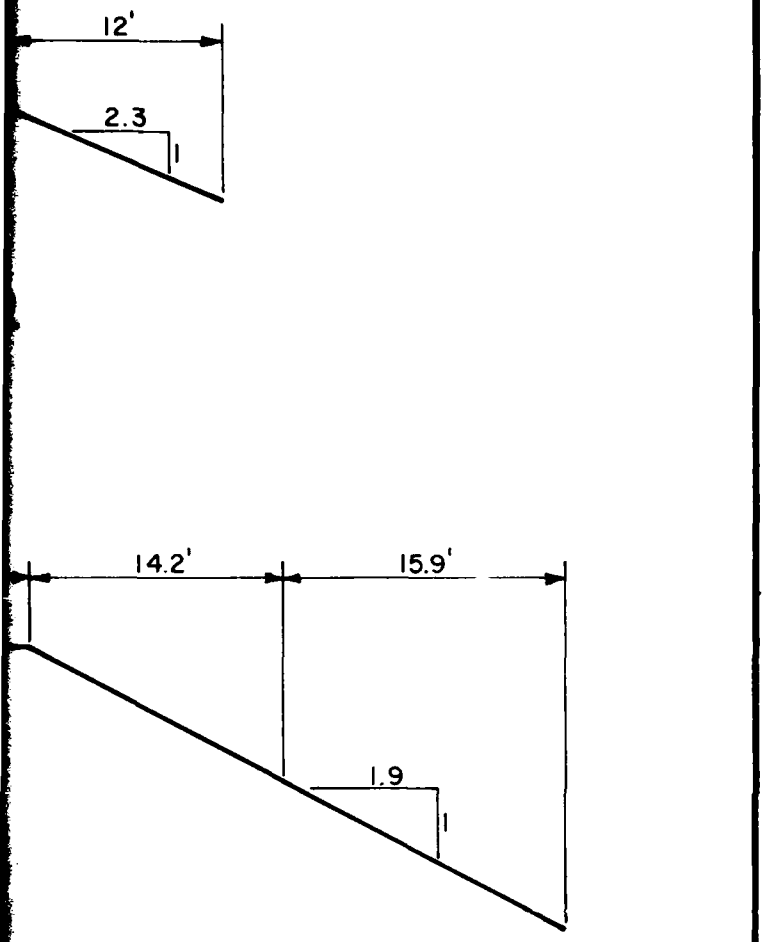


STA. 4+8

SCALE: 1 IN. = 1



NOTE: PLAN, PROFILE, AND SECTIONS WER
FROM LIMITED SURVEY DATA OBTAINE
INSPECTION. IT SHOULD NOT BE CON
DEFINITIVE.



FT.

20

DRAWN
FOR THIS
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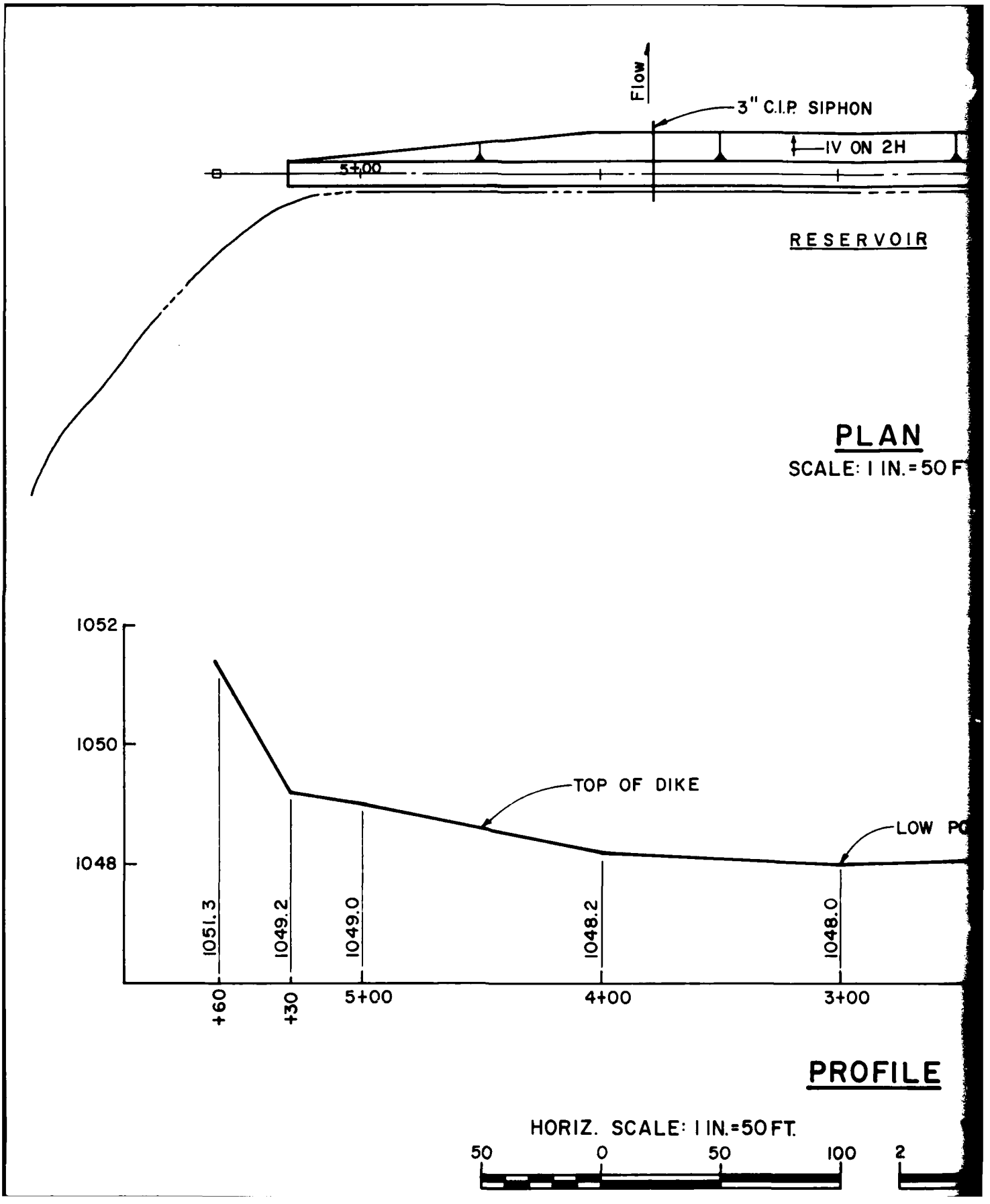
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

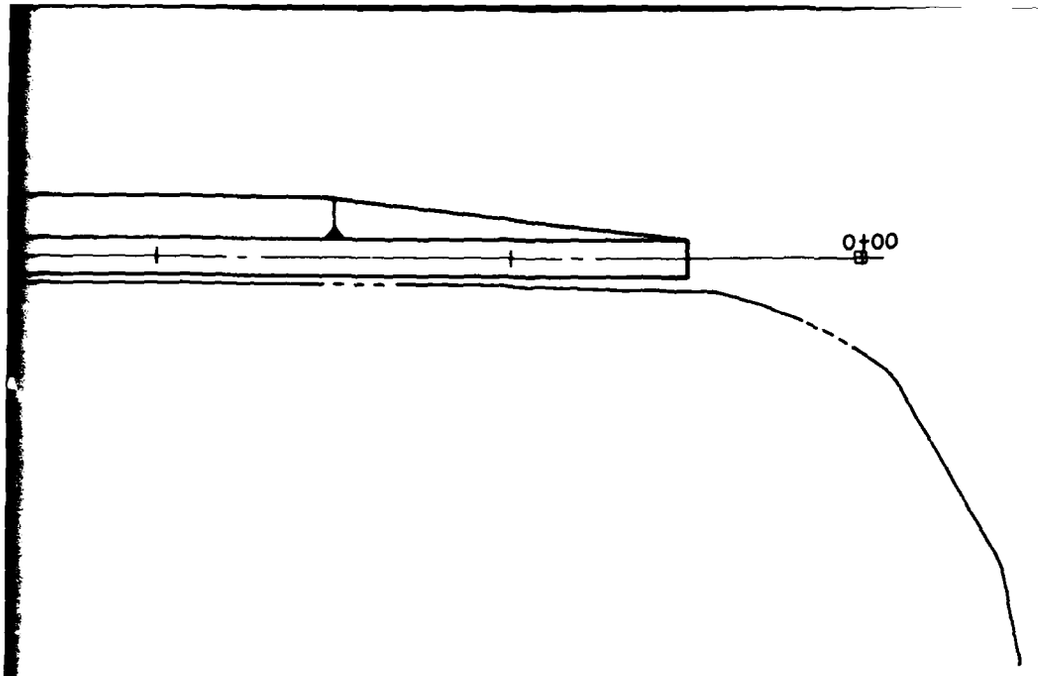
MOUNTAIN SPRINGS LAKE DAM

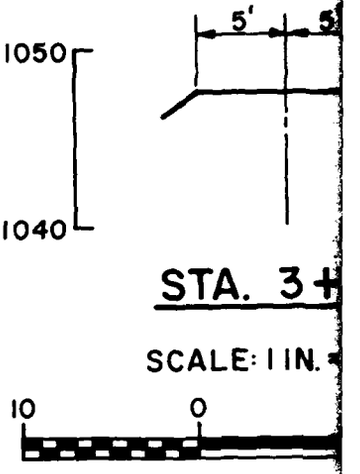
JACK B. RADER

PLAN, PROFILE AND SECTIONS OF DAM

JANUARY 1980 PLATE E-12


Flow
3" C.I.P. SIPHON
IV ON 2H
5+00
RESERVOIR
PLAN
SCALE: 1 IN. = 50 F
1052
1050
1048
TOP OF DIKE
LOW PO
1051.3
1049.2
1049.0
1048.2
1048.0
+60
+30
5+00
4+00
3+00
PROFILE
HORIZ. SCALE: 1 IN. = 50 FT.
50
0
50
100
2

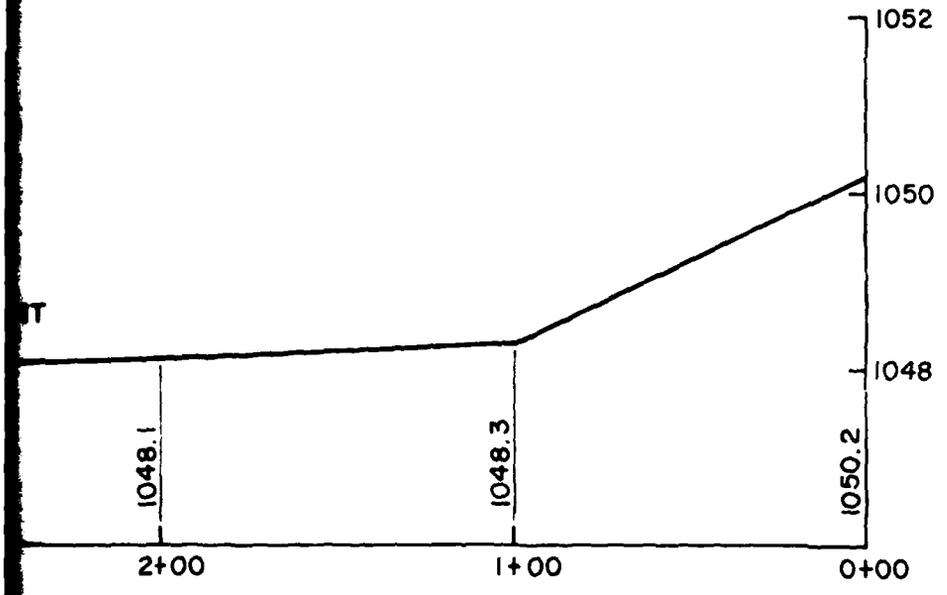




STA. 3+

SCALE: 1 IN. =

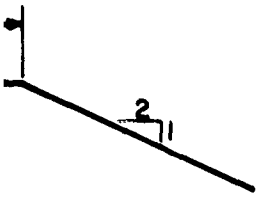
10 0



NOTE: PLAN, PROFILE, AN
FROM LIMITED SUR
THIS INSPECTION.
CONSIDERED DEFIN

RT. SCALE: 1 IN. = 2 FT.

0 2 4



78

O FT.

10 20

SECTION WERE DRAWN
Y DATA OBTAINED FOR
T SHOULD NOT BE
IVE.

PHASE I INSPECTION REPORT
TIONAL DAM INSPECTION PROGRAM

NTAIN SPRINGS LAKE DAM

JACK B. RADER

LAN, PROFILE AND
SECTION OF DIKE

ARY 1980 PLATE E-3

APPENDIX F

GEOLOGY

MOUNTAIN SPRINGS LAKE DAM

APPENDIX F

GEOLOGY

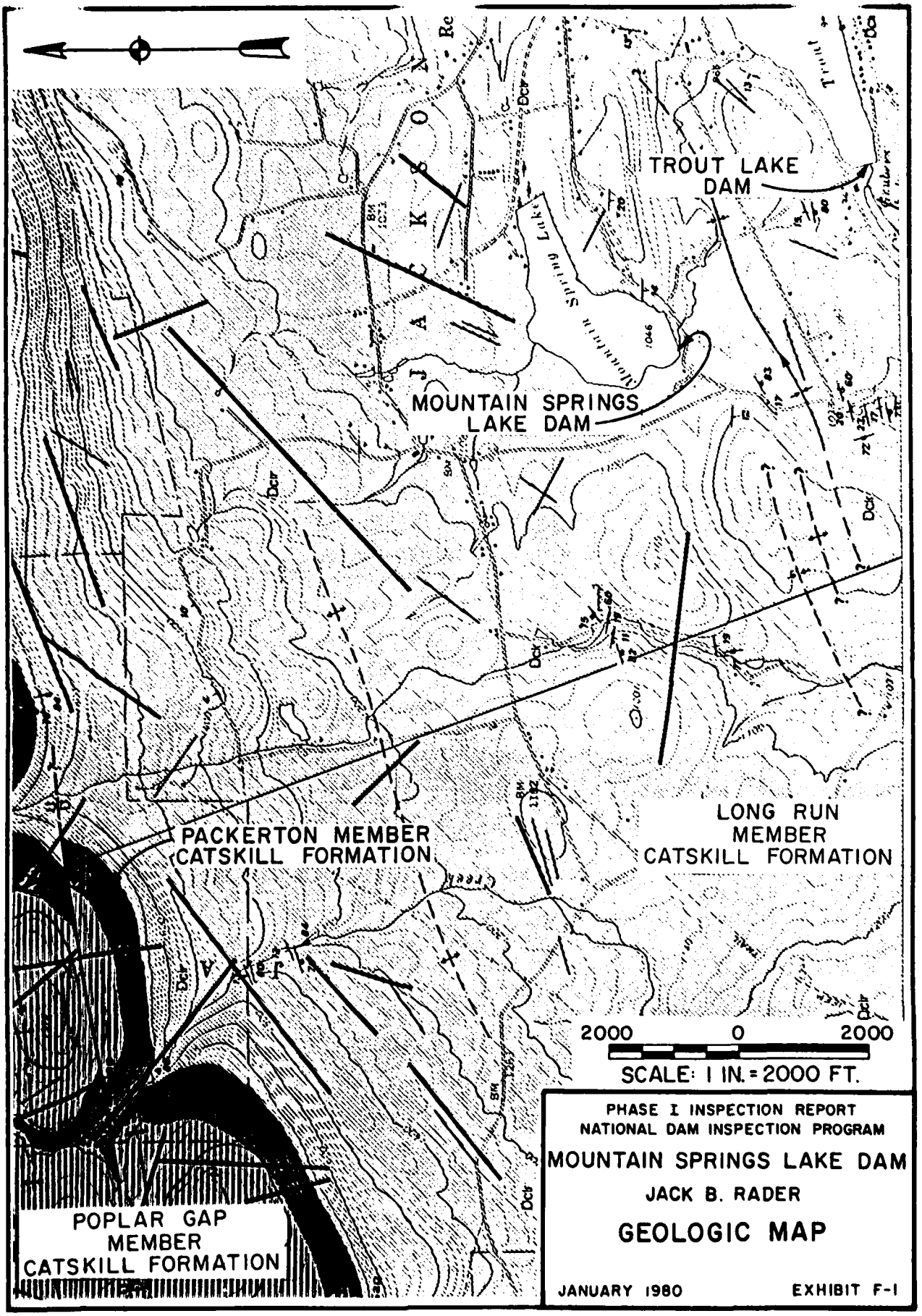
Mountain Springs Lake Dam is located in Monroe County within the Appalachian Plateau Physiographic Province. The most pronounced topographic feature in the area is Camelback Mountain, which is a part of the Pocono Escarpment. The greatest relief along the escarpment is 1,000 feet, which occurs at Camelback Mountain. Streams east of the escarpment drain directly into the Delaware River, while those to the west drain to the Lehigh River. The Poconos Plateau section lies to the west of the escarpment. The Glaciated Low Plateaus section is east of the escarpment and is characterized primarily by preglacial erosional topography with locally-thick, glacial deposits. Generally, local relief is 100 to 300 feet.

Mountain Springs Lake Dam is located within the Glaciated Low Plateau section. Bedrock units of the section include siltstones of the Mahantango Formation, siltstones and shales of the Frimmers Rock Formation, and seven mapped members of the Catskill Formation. These members include sandstones, siltstones, and shales of the Towamensing Member; sandstone, siltstone, and shale of the Walcksville Member; sandstones, siltstones, and shale of the Beaverdam Run Member; sandstone and shale in the Long Run Member; sandstones and conglomerates in the Packerton Member; sandstones and some conglomerates in the Poplar Gap Member; and sandstones and conglomerates in the Duncannon Member.

Mountain Springs Lake Dam is underlain by the Long Run Member of The Catskill Formation. The Long Run Member is predominantly sandstone with interbedded siltstone and shale. The sandstones are primarily fine-to medium-grained, composed of well-sorted, quartz grains with some rock fragments in a clay matrix with silica or carbonate cement. Low to moderate primary porosity, caused by weathering of the carbonate cement, combined with moderate to high fracture porosity, yields a significant effective porosity for the sandstones. Very fine-grained siltstones and clay shales that are present have low primary porosity. Secondary porosity attributable to fractures is low to moderate.

The sandstones and siltstones of the Long Run Member maintain high angle cut slopes. The shales, when exposed, weather rapidly. Because of their relatively low porosity, the shales and fine-grained siltstones are well-suited for impoundment sites. When excavated to sound bedrock, the Long Run Member is reported to be a good foundation for heavy structures.

Available records do not identify the materials on which the dam is founded.


TROUT LAKE DAM
MOUNTAIN SPRINGS LAKE DAM
PACKERTON MEMBER CATSKILL FORMATION
LONG RUN MEMBER CATSKILL FORMATION
POPLAR GAP MEMBER CATSKILL FORMATION
2000 0 2000
SCALE: 1 IN. = 2000 FT.
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
MOUNTAIN SPRINGS LAKE DAM
JACK B. RADER
GEOLOGIC MAP
JANUARY 1980
EXHIBIT F-1